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the given circumference, (x, y, z) ; and the coördinates of M , the projection of P on the xy plane, (x, y) .

$$\text{Then } DC = bx/a; BC = \sqrt{(a^2 + b^2)} \frac{x}{a};$$

$$CA = \frac{\sqrt{(a^2 + b^2)}(a-x)}{a}; \text{ and } PC = \sqrt{(BC \cdot CA)}$$

$$= \frac{\sqrt{[(a^2 + b^2)(a-x)x]}}{a}.$$

$$\therefore DP^2 = \frac{b^2 x^2 + (a^2 + b^2)(a-x)x}{a^2}.$$

As the circle with radius DP moves parallel to itself and with its center on AB , it generates the volume required.

$$\therefore V = \frac{\pi}{a^2} \int_0^a [b^2 x^2 + (a^2 + b^2)(a-x)x] dx = \frac{\pi a}{6} (a^2 + 3b^2).$$

MECHANICS.

97. Proposed by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Science, Chester High School, Chester, Pa.

The side AB of the parallelogram $ABCD$ will be a principal axis at the point which divides the distance between the middle point and the foot of the perpendicular from the middle-point of the opposite side in the ratio 2 : 1. The principal moments of inertia about this point are $\frac{1}{8}mb^2 \sin^2 \beta$, $\frac{1}{8}m(3a^2 + 4b^2 \cos^2 \beta)$, where $\beta = \angle A$.

Solution by the PROPOSER.

Let $EH = c$, and let H be the origin, and lines through H parallel to EF , FB axes of coördinates.

$$\therefore \sum mxy = \rho \sin^2 \beta \int_{-\frac{1}{2}a-c}^{\frac{1}{2}a-c} \int_0^b y(x+y \cos \beta) dx dy$$

$$= \frac{1}{8}mb \sin \beta (2b \cos \beta - 3c) = 0 \text{ if } HB \text{ is a principal axis.}$$

$$\therefore c = \frac{2}{3}b \cos \beta. \text{ But } FG = b \cos \beta. \therefore FH : HG = 2 : 1.$$

$$\sum my^2 = \rho \sin^3 \beta \int_{-\frac{1}{2}a-c}^{\frac{1}{2}a-c} \int_0^b y^2 dx dy = \frac{1}{8}mb^3 \sin^2 \beta.$$

$$\sum mx^2 = \rho \sin \beta \int_{-\frac{1}{2}a-c}^{\frac{1}{2}a-c} \int_0^b (x+y \cos \beta)^2 dx dy = \frac{1}{8}m(a^2 + 12c^2 - 12b \cos \beta + 4b^2 \cos^2 \beta)$$

$$= \frac{1}{8}m(3a^2 + 4b^2 \cos^2 \beta).$$

